PCT
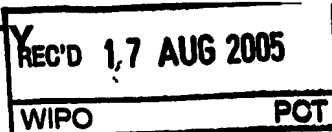
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 45971.WO01/NER	FOR FURTHER ACTION	See Form PCT/PEA/416

International application No. PCT/GB2004/003161	International filing date *(day/month/year)* 21.07.2004	Priority date *(day/month/year)* 21.07.2003

International Patent Classification (IPC) or national classification and IPC
H04N5/217, G06T5/00

Applicant
E2V TECHNOLOGIES (UK) LIMITED et al.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

    a. ☒ *sent to the applicant and to the International Bureau)* a total of 1 sheets, as follows:

    ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

    ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

    b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

    ☒ Box No. I   Basis of the opinion
    ☐ Box No. II   Priority
    ☐ Box No. III   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
    ☐ Box No. IV   Lack of unity of invention
    ☒ Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
    ☐ Box No. VI   Certain documents cited
    ☐ Box No. VII   Certain defects in the international application
    ☐ Box No. VIII   Certain observations on the international application

Date of submission of the demand 18.05.2005	Date of completion of this report 16.08.2005

Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Schreib, F Telephone No. +49 89 2399-7114

Box No. I   Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language ,
   which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☐ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

   Description, Pages

1-12	as originally filed

   Claims, Numbers

7-19	as originally filed
1-6	received on 18.05.2005 with letter of 13.05.2005

   Drawings, Sheets

1/4-4/4	as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing *(specify)*:
   ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing *(specify)*:
   ☐ any table(s) related to sequence listing *(specify)*:

   * *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

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1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-19
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations (Rule 70.7):

   see separate sheet

Re Item V.

1. The following documents are referred to in this communication:
   D1 : US 4 490 744 A (LEVINE PETER A) 25 December 1984 (1984-12-25)
   D2: GB-A-2 364 461 (HEWLETT PACKARD CO) 23 January 2002 (2002-01-23)
   D3: EP-A-0 777 380 (SANYO ELECTRIC CO) 4 June 1997 (1997-06-04)
   D4: EP-A-0 866 501 (EEV LIMITED) 23 September 1998 (1998-09-23)

   The document D4 was not cited in the international search report but it was cited by the applicant in the description of the application on page 1, line 6.

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not inventive in the sense of Article 33(3) PCT.

2.1 Document D4 discloses a CCD imager comprising an image area and a multiplication register for multiplying charge produced by the image area *(see D4, abstract and Fig. 1)*. D4 does not disclose any means to combat the smears produced by the multiplication register. Therefore the problem to be solved stays how to perform smear reduction in CCD imagers.

2.2 Document D1 (the references in parenthesis applying to this document) discloses the following apparatus to solve this problem:

   Apparatus for compensating image signals produced by a CCD imager for smears *(see col. 1, lines 12-15)*, the apparatus comprising:

   an image data analyser for detecting the boundaries of a smear *(see col. 12, lines 57- 62 and col. 13, lines 9-13: The edge detector is an image data analyser with the purpose of detecting the boundaries of a smear. Therefore the edge detector decides by controlling the smear switch that the smear has to be subtracted from additional pixels)* ; and

   an image data replacer for replacing data between the boundaries of a detected

smear with alternative image data *(see col. 13, lines 9-13: The pixels between 2 detected edges are replaced by other data namely the originally data minus stored values from the smear memory. Therefore the subtractor 328 is an image data replacer)*, wherein the image data analyser is arranged to detect the boundaries of horizontal *(see col. 13, lines 5-8: column addresses are addresses within one horizontal line. The edge detector stores column addresses. Therefore it detects boundaries of horizontal smears)* smears produced by incomplete charge transfer in the multiplication register *(if the image data analyser detects the boundaries of horizontal smears it also detects the subset of horizontal smears produced by incomplete charge transfer in the multiplication register)*.

2.3 Therefore the person skilled in the art would arrive at the subject-matter of claim 1 by combining the teachings of D1 and D4 without an inventive step.

3. The subject-matter of claim 2 does not meet the requirements of Article 33(2) PCT. According to D1, col. 12, lines 57-59 the edge detector includes differentiating circuits. This is another term for circuits "detecting rates of change in the image data". As the edge detector has to take a decision what pixel about the occurrence of the leading edge of the right most pixel of the right most spot it has the implicit feature that the result of the differentiating circuits is compared with a threshold.

4. The subject-matter of claims 3-5 does not meet the requirements of Article 33(3) PCT. Deriving the values of smeared pixels from its neighbours by interpolation or gradient analysis belongs to the standard methods of image processing *(see e.g. D2, page 1, lines 15-26; page 6, lines 12-27)*. Therefore a person skilled in the art arrives at the subject-matter of claims 3-5 without an inventive step.

5. In dependent claims 11-13 features of the CCD imager are added which already are disclosed by D1. D1 shows an imager in Figure 1 comprising an image area for accumulating charge. It also contains an output register. There is one row of pixels which are masked from incident radiation. Figure 2a also shows a subtractor for subtracting the smear signal which is derived from the masked row.

Therefore the subject-matter of claims 11-13 is not inventive.

6. Dependent claims 6-10 and 14-17 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, the reasons being as the person skilled in the art arrives at the subject-matter of these claims by combining the teaching of D1 and D4 with general technical knowledge.

7. The subject-matter of claim 18 discloses a CCD imager with the smear correction apparatus of claim 1. D1 also the discloses that the apparatus of claim 1 is applied in a CCD imager. Therefore the subject-matter of claim 18 is not inventive.

8. D1 also discloses the usage of the imager of claim 1 in a camera *(see D1, col. 4, lines 55-58)*. Therefore the subject-matter of claim 19 is not inventive.

CLAIMS

1.   A CCD imager comprising an image area, a
multiplication register for multiplying charge produced by
the image area and apparatus for compensating image
signals produced by the multiplication register for
smears, the apparatus comprising:
        an image data analyser for detecting the boundaries
of a smear; and
        an image data replacer for replacing data between the
boundaries of a detected smear with alternative image
data, wherein the image data analyser is arranged to
detect the boundaries of horizontal smears produced by
incomplete charge transfer in the multiplication register.

2.   Apparatus according to claim 1, wherein the image
data analyser comprises means for detecting the boundaries
of a smear by detecting rates of change in the image data
greater than a predefined limit

3.   Apparatus according to claim 1 or 2, wherein the
alternative image data is derived from image pixels
neighbouring the detected smear.

4.   Apparatus according to claim 1 or 2, wherein the
alternative image data is derived by interpolation of
image data.

5.   Apparatus according to claim 2, 3, or 4, wherein the
image data analyser analyses the image line by line to
detect intensity gradients greater than the predefined
limit.

6.   Apparatus according to any preceding claim, wherein
the image data analyser comprises a kernel for analysing a
portion of the image data at a time.